OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P8.1 PHYSICS ON THE MOVE

SCORE	PERCENTAGE
/110	%

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Gateway Physics A (9-1)

Physics on the move

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **110**.
- The total number of marks may take into account some 'either/or' question choices.

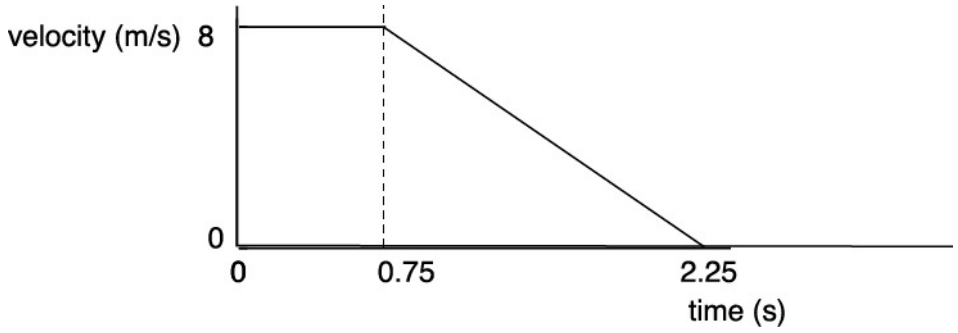
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1 A car takes 6 m to brake when moving at 8 m/s.

Look at the graph of the car as it starts to brake and then stopping.



Use the graph to show that the braking distance is 6 m.

---

[2]

2 Jin drives her car at a steady speed.

Look at the situations in which she drives her car along a straight road at 60 km/hr.

A with one passenger.
B with one passenger and towing a caravan.
C with one passenger and a roof rack on the car.
D with one passenger and a cycle rack attached to the back of the car.

Which situation will give her the best fuel consumption?

Choose from A B C D

answer _____

[1]

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3 The table shows the stopping distances for a car.

Speed of car (m/s)	Thinking distance (m)	Braking distance (m)	Total stopping distance (m)
4	3	1.5	4.5
8	6	6	12
16	12	24	36
32	24		

Use the data given to fill in the information missing at a speed of 32 m/s.

[2]

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4 Look at the information about thinking distance and braking distance for cars travelling at 13 m/s.

Driver	Thinking distance in metres	Braking distance in metres
Sam	9	14
Chris	9	25
Jo	15	14
Ben	7	10

One of the drivers is tired after driving for several hours.

Suggest which driver is tired.

answer _____

Explain fully why you chose this driver.

One of the drivers was driving on an icy road.

Suggest which driver was driving on an icy road.

answer _____

Explain fully why you chose this driver.

---

[2]

5 A car is fitted with seatbelts.

Write about the risks and benefits of wearing a seat belt when travelling in a car.

---

[2]

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6 Very old cars did not have seat belts.

The first seat belts were only fastened across the lap of the driver.

Modern seat belts pass over the shoulder and lap of all passengers.

This is one example of how the design of seat belts has been developed for cars.

Describe how scientists could collect data to compare and improve the design of seat belts.

---

[2]

7(a) There are other safety features in modern cars that reduce injuries. They work in a similar way to seat belts.

Write down two **other** safety features of modern cars that work in a similar way to seat belts.

1

2

---

[1]

(b) Seat belts reduce injuries in a crash.

Explain how.

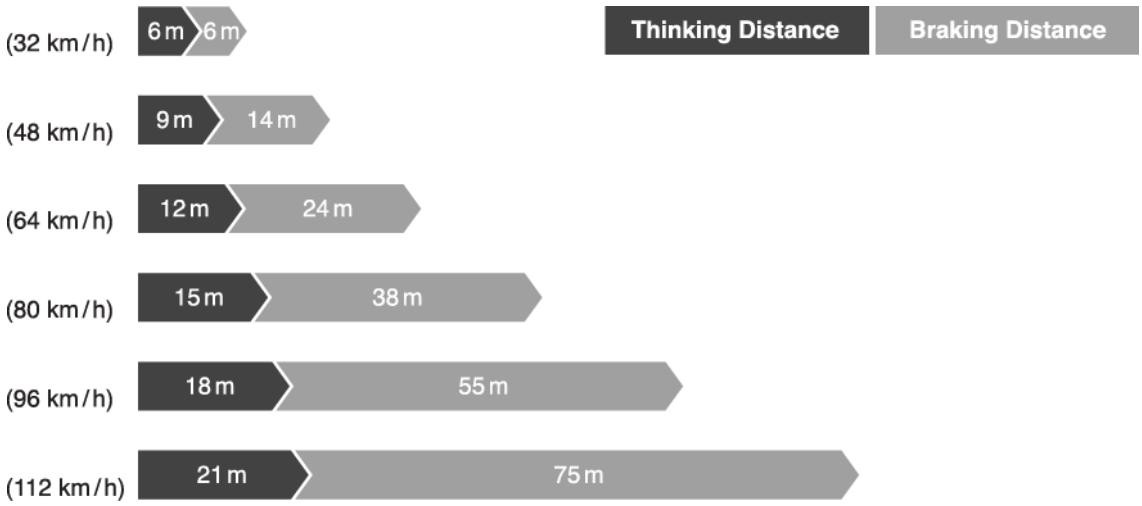
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[2]

(c)

(i) Look at the data about stopping distances.

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Ben says that “doubling the driving speed doubles the thinking distance”.

Chloe says “so, if I double the speed of my car, this will double the stopping distance”.

Is Chloe correct?

_____

Explain your answer.

_____

_____

_____

_____

_____ [2]

(ii) One factor which increases the **braking** distance of the car is higher speed.

Write down two other factors that increase braking distance.

1

_____

2

_____

[1]

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8 Very old cars did not have seat belts.

The first seat belts were only fastened across the lap of the driver.

Modern seat belts pass over the shoulder and lap of all passengers.

This is one example of how the design of seat belts has been developed for cars.

Describe how scientists could collect data to compare and improve the design of seat belts.

---[2]

9(a) Seat belts reduce injury by absorbing energy when the car stops suddenly.

Write about other safety features that absorb energy when the car stops suddenly.

---[2]

(b) The seat belt exerts a force on the passenger when a car is stopping.

This force causes a change in momentum of the passenger.

Look at the table for four different passengers when their car stops.

Passenger	Change in momentum of passenger in kg m/s	Passenger stopping time in seconds
A	1440	4
B	1224	2
C	1200	3
D	1000	1

Which passenger experiences the greatest **force** from their seat belt?

Choose from: A B C D

answer _____

[1]

10 Look at the information about thinking distance and braking distance for cars travelling at 13 m/s.

Driver	Thinking distance in metres	Braking distance in metres
Sam	9	14
Chris	9	25
Jo	15	14
Ben	7	10

One of the drivers is tired after driving for several hours.

Suggest which driver is tired.

answer _____

Explain fully why you chose this driver .

One of the drivers was driving on an icy road.
Suggest which driver was driving on an icy road.

answer _____

Explain fully why you chose this driver.

---

[2]

11(a) Different factors can **increase** the thinking distance and the braking distance of a car.

(i) Write down one factor that increases **thinking distance**.

---

[1]

(ii) Write down one factor that increases **braking distance**.

---

[1]

(b) Explain what this warning means.

"you are driving inside the thinking distance of the car in front"

---

[1]

12 A car accelerates from 0 to 60 mph (miles per hour) in about 9 seconds.

Use the relationship: 1 m/s = 2.24 mph

Estimate the acceleration for this car in m/s^2.

A 1 m/s^2

B 3 m/s^2

C 7 m/s^2

D 15 m/s^2

Your answer ☐ **[1]**

13 A student measures the time it takes for a bicycle to stop in an emergency.

She repeats the measurement to get three results.

The average time for her results is 2.72 s.

The first two results are 2.66 s and 2.60 s.

What is the value of her third result?

A 2.63 s

B 2.66 s

C 2.72 s

D 2.90 s

Your answer ☐ **[1]**

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14 An adult on a bicycle travels at 8 m/s on a level road. She sees a hazard and applies her brakes using full force.

Estimate the force of the brakes.

A 5 N

B 50 N

C 500 N

D 5000 N

Your answer [1]

15(a) A scientist uses different drivers to test the stopping distances of the same car.

Look at the results.

Driver	Speed (m/s)	Thinking distance (m)	Braking distance (m)
A	8	6	6
B	16	13	24
C	32	24	96
D	16	12	22
E	8	5	6
F	32	30	120

Most of the drivers tested the car on a dry day, on a level road.

Which driver tested the car on an **icy** road?

Driver ..... tested the car on an **icy** road. [1]

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(b) Which driver has the **quickest** reaction time?

Driver ..... has the **quickest** reaction time.

Calculate their reaction time.

Answer = ---------- s **[3]**

(c) Give two drivers that have the **same** reaction time.

Drivers ..... have the **same** reaction time.

Explain your answer.

---**[2]**

(d) Driver **B** travels at 16 m/s on the road. The thinking distance is 13 m and the braking distance is 24 m.

Driver **B** now drives the car **uphill** at the same speed on the same road.

How will driving the car **uphill** affect thinking, braking and stopping distances?

The reaction time will stay the same.

Complete the sentences.

The **thinking distance** will ----------

The **braking distance** will ----------

The **stopping distance** will ----------

[2]

16 Estimate the typical cruising speed of a jet airliner.

A 25 m/s

B 250 m/s

C 2 500 m/s

D 25 000 m/s

Your answer ☐ **[1]**

17 A student experiments with a model parachute and collects some results.

She drops the parachute from a height of 4 m three times and takes three results of the time taken.

The three results are:

3.25 s
3.00 s
3.08 s

What is the mean of the three results?

A 3.00 s

B 3.08 s

C 3.11 s

D 3.25 s

Your answer [ ] **[1]**

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18 Fig. 20.1 shows thinking, braking and stopping distances for the same car travelling at different speeds.

Speed (m/s)	Thinking distance (m)	Braking distance (m)	Stopping distance (m)
8	6	6	12
16	12	24	36
32	24	96	120

Fig. 20.1

Calculate the reaction time of the person driving the car.

Answer = _____ s [3]

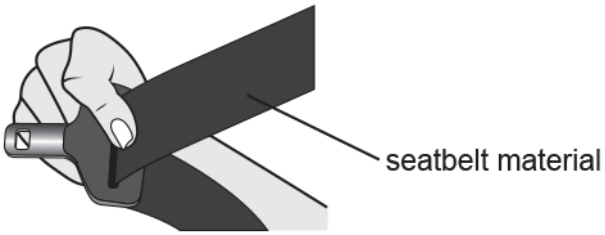
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19

Seatbelts in cars are made of a wide material that stretches in a crash.



(i) Explain why it is important that the material is **wide.**

---

[1]

(ii) Explain why it is important that the material is **stretchy.**

---

[1]

20 This question is about force, mass and acceleration.

A car starts from rest and accelerates at 3 m/s^2.

Use the equation: Acceleration = Change in velocity ÷ Time taken

Calculate the **velocity** of the car after 4 s.

Answer = ---------- m/s **[2]**

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21

Children in cars use special seats with their own seatbelts.



The seatbelts for children are narrower than adult seatbelts.

Why is it safe for children's seatbelts to be **narrower** than adult seatbelts?

---

[2]

22 This question is about force, mass and acceleration.

A roller coaster car moves down a slope with an acceleration of 5 m/s^2.

The force on the roller coaster car is 4000 N.

Calculate the **mass** of the roller coaster car.

Answer = _____ kg **[2]**

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23 A domestic wind turbine has a power rating which varies from 1.0 kW to 3.0 kW.

(i) The domestic wind turbine has an electrical resistance of 23 Ω.

It generates a current of 11 A on a windy day.

Calculate the **power** output in kW of the turbine on this day.

Answer = ______________________ kW **[4]**

(ii) Suggest why the manufacturer gives a range for the power rating of the wind turbine.

____

____ **[1]**

(iii) Using just **one** domestic wind turbine may be an unreliable source of power for a house.

State a reason why.

____

____ **[1]**

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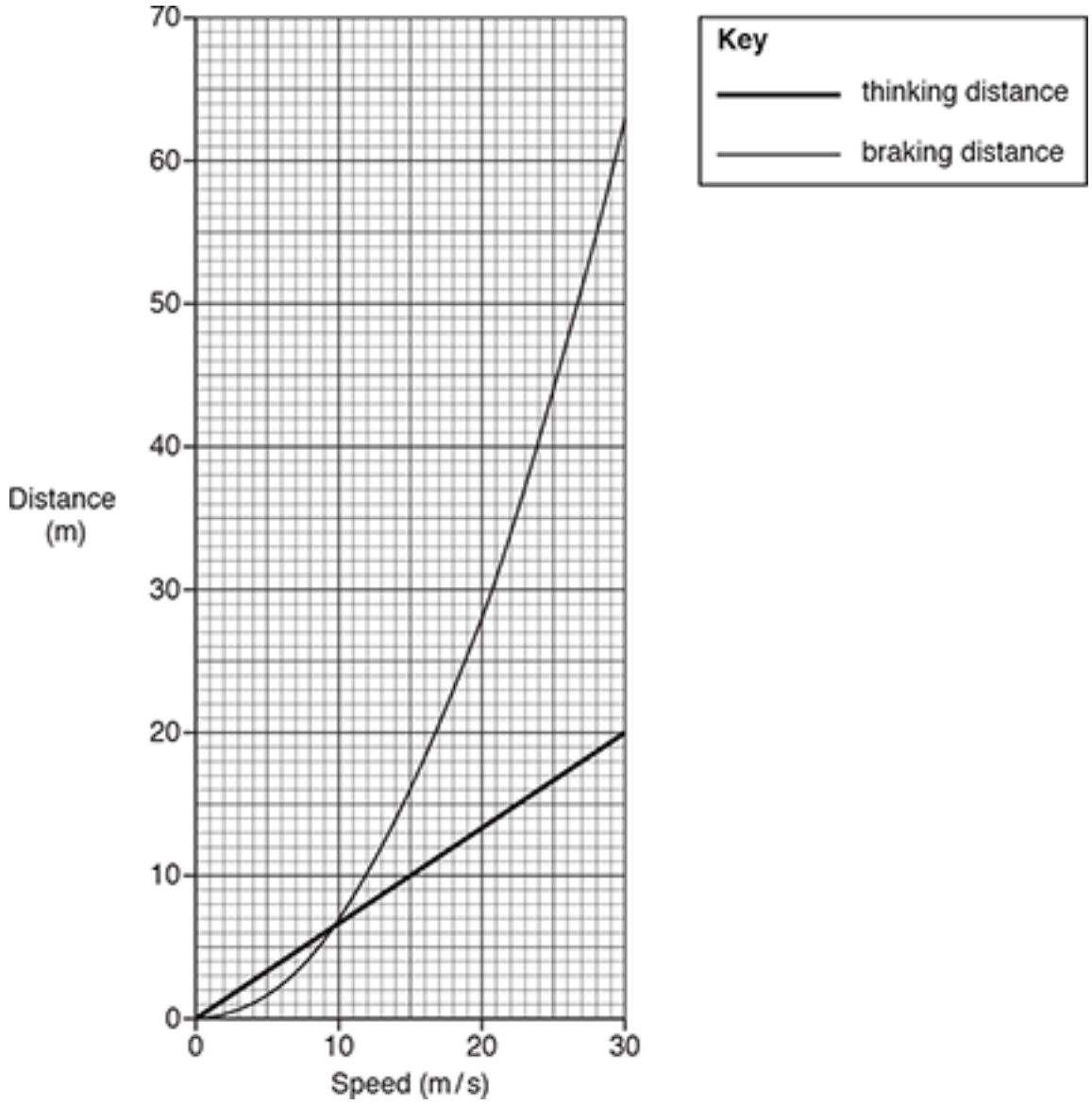
24 Which row in the table shows realistic speeds?

	Speed (m / s)		
	Road cyclist	Gale force wind	Sound in air
A	40	12	1000
B	6	24	340
C	20	6	760
D	15	55	250

Your answer [1]

25(a) The graph shows thinking and braking distances for a car at different speeds.

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Describe how **thinking distance** varies with increasing speed.

Use data from the graph in your answer.

[2]

(b)

(i) Use the graph to find the **thinking distance** at 24 m / s.

Thinking distance =..... m **[1]**

(ii) Calculate the **thinking time** at 24 m / s.

Use your answer to **(i)** and the equation: distance travelled = speed × time

Give your answer to **2** decimal places.

Thinking time =..... s **[3]**

(c)

(i) State **one** factor that could **increase** thinking distance.

[1]

(ii) Calculate the **stopping distance** at 15 m / s.

Use the graph to help you.

Stopping distance = ... m **[2]**

(d) How does the speed affect the **kinetic energy** and **braking distance** of the car?

Use the graph in your answer.

[3]

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26(a) **Fig. 21.1** is a speed-time graph for car **P**.

The driver of car **P** reacts to a traffic light at time = 0.00 s, then presses the brakes at time = 0.50 s.

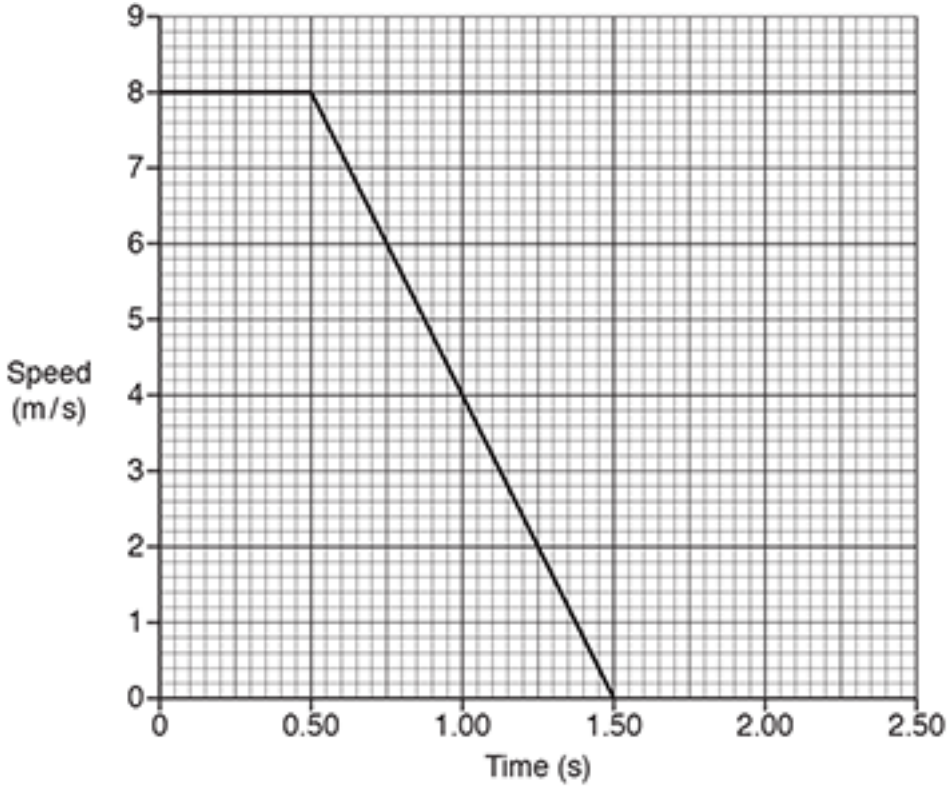


Fig. 21.1

(i) The braking distance is the same size as the thinking distance.

Explain how the graph in **Fig. 21.1** shows this.

---

[1]

(ii) Add another line to the graph in **Fig. 21.1** to show the journey of car **Q**.

- Car **Q** is travelling at 8 m / s.
- The driver of car **Q** reacts, then presses the brakes after 0.75 s.
- Car **Q** decelerates at the same rate as car **P**.

[2]

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(b) Driver **P** measures the reaction time of driver **Q** using a 30 cm ruler.

Driver **P** drops a 30 cm ruler vertically and driver **Q** catches it.

(i) Explain how the ruler can be used to estimate reaction time.

---

[1]

(ii) State **one** precaution they can use to get accurate results.

---

[1]

(c) In the brakes of a car there are brake pads and a brake disc, as shown in **Fig. 21.2**.

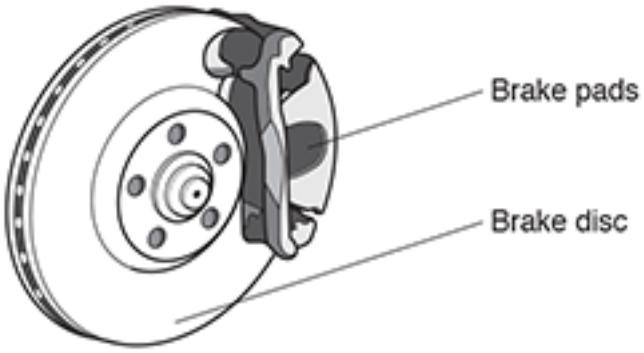


Fig. 21.2

When a car stops, energy transfers between stores.

The brake pads squeeze the brake disc and cause a friction force.

(i) Explain how braking stops the car.

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Include ideas about **energy stores** in your answer.

[2]

(ii) High speed cars have ventilated brakes with air holes in the disc, as shown in **Fig. 21.3.**

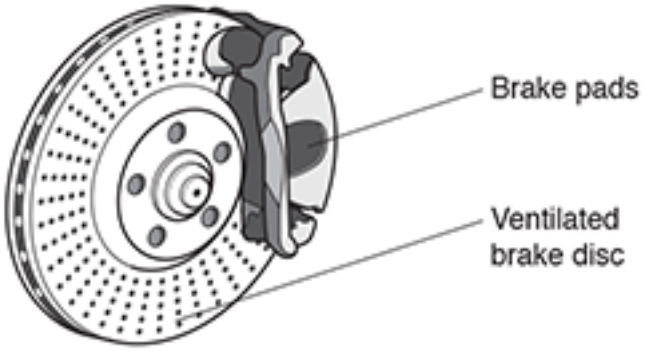


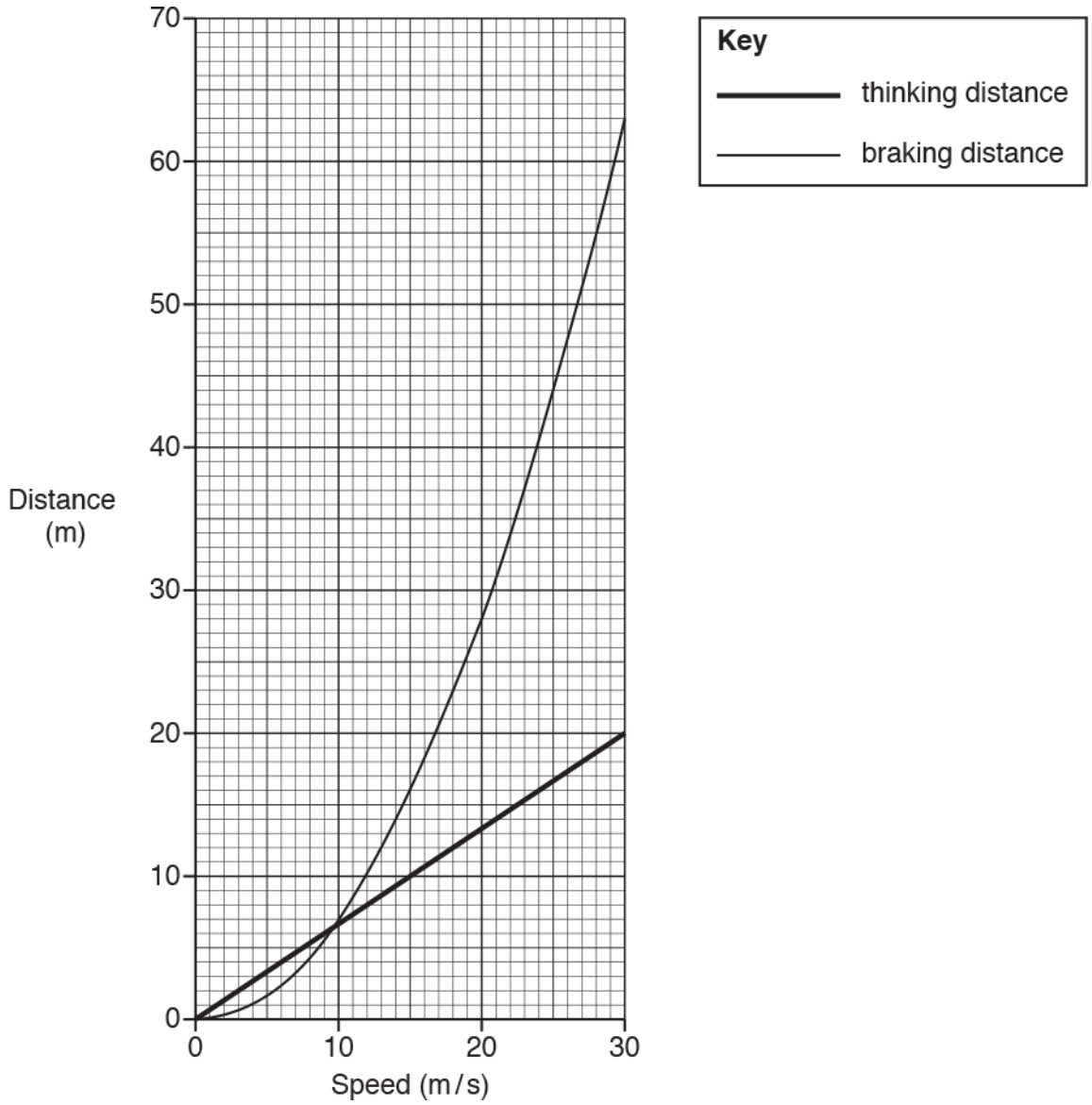
Fig. 21.3

The air holes allow more air to circulate around the disc.

Suggest how these brakes can reduce braking distances.

[1]

27(a) The graph shows thinking and braking distances for a car at different speeds.



(i) Use the graph to find the **thinking distance** at 24 m / s.

Thinking distance = ... m **[1]**

(ii) Calculate the **thinking time** at 24 m / s.

Use your answer to **(i)** and the equation: distance travelled = speed × time

Give your answer to **2** decimal places.

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Thinking Time = ... s **[3]**

(b)

(i) State **one** factor that could **increase** thinking distance.

[1]

(ii) Calculate the **stopping distance** at 15 m / s.

Use the graph to help you.

Stopping distance = ... m **[2]**

(c) How does the speed affect the **kinetic energy** and **braking distance** of the car?

Use the graph in your answer.

[3]

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28 A car travels at a speed of 60 mph (miles per hour).

1 mph = 0.45 m / s.

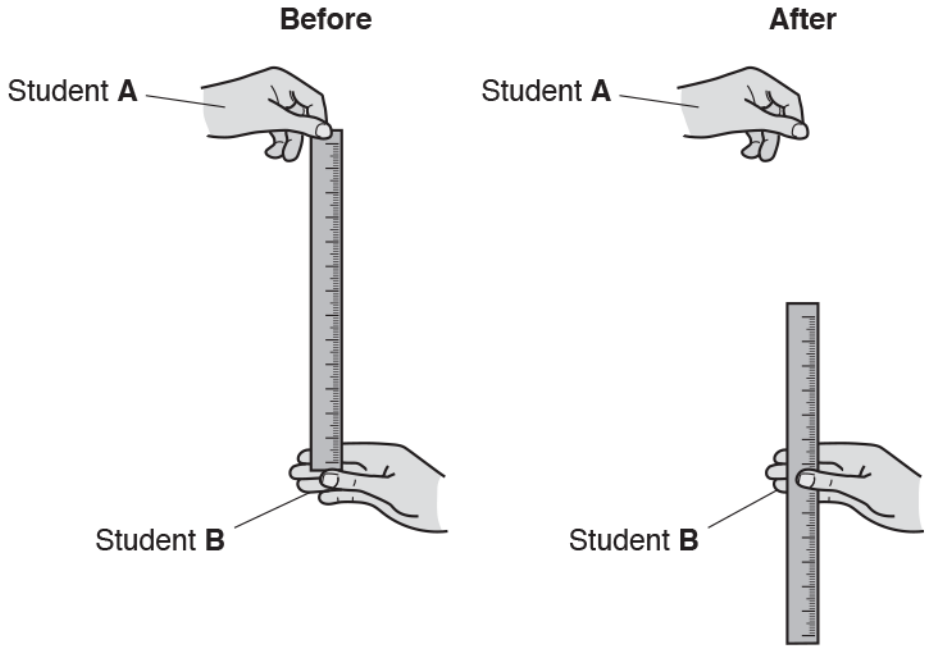
Convert 60 mph into m / s (metres per second).

A 0.45 m / s
B 7.5 m / s
C 27 m / s
D 130 m / s

Your answer ☐ **[1]**

29(a)

The diagram shows a ruler being used to estimate a student's reaction time.



(i) Describe how the ruler can be used to estimate student **B**'s reaction time.

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[2]

(ii) Why do the students repeat the experiment several times?

[1]

(iii) Student **B** is very tired when they try this experiment.

Suggest how this might affect student **B**'s reaction time.

[1]

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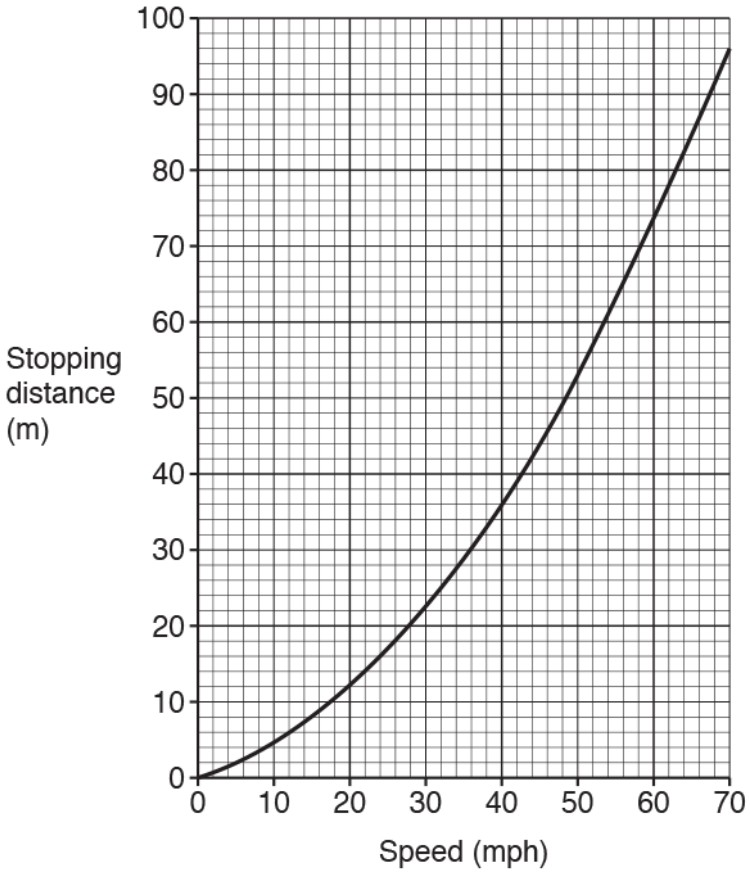
(b) The driver of a car makes an emergency stop.

The thinking distance is 9 m. The braking distance is 14 m.

(i) Calculate the total stopping distance of the car.

Stopping distance = ... m **[1]**

(ii) This graph shows how this driver's stopping distance changes with speed.



- A car is travelling at 50 mph.
- There is a barrier in the road 40 m in front of the car.

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- The driver makes an emergency stop.

Use the graph to work out if the car hits the barrier.
Explain how you obtained your answer.

[2]

(iii) State one factor, other than speed, that affects braking distance.

Explain how this factor changes braking distance.

Factor

Explanation

[3]

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(c)

(i) A car travels at a speed of 13 m / s. The car takes 4 s to stop after the brakes are applied.

Calculate the deceleration of the car.

Use the equation: acceleration = change in velocity ÷ time

Deceleration = ...m / s^2 **[3]**

(ii) The braking system of the car in **(i)** is changed. The same car travelling at 13 m / s now takes 0.4 s to stop after the brakes are applied.

The driver says, 'The new braking system is ten times safer.'

Do you agree with the driver? Explain your answer.

Yes ☐

No ☐

---

[2]

(iii) Suggest **one** safety feature in a car that can reduce injury in a crash.

---

[1]

30 A car travels at a speed of 70 mph (miles per hour).

1 mile is approximately 1600 metres.

Convert 70 mph into m / s (metres per second).

A 2.6 m / s
B 31 m / s
C 112 m / s
D 160 m / s

Your answer [ ] **[1]**

END OF QUESTION PAPER

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